

NASA NDE WORKING GROUP NEWSLETTER

August 1995

Quarterly Newsletter

VOL. 3, NO. 3

NASA HQ CODE QW MESSAGE

J. Siedlecki, 202-358-0205

The recent 2nd NDE workshop, that was held at MSFC from May 9 to 10, 1995, was a great success. Dr. Greenfield, Deputy Associate Administrator, Code Q, attended the Workshop and appreciated the frank and open discussions of the status of the current RTOP activities. I want to thank our hosts at MSFC, Dr. Russell and Bob Neuschaefer, for the efforts to make the workshop a success.

As previously discussed during the NDE Telecon the preliminary results of our RTOP submittals will provide for the continuation of the funding for the NDE newsletter, the Radioactive gas penetrant effort at LeRC, initiation of the JPL/LaRC composite effort, development of the reflectometer at KSC and the continuation of the POD effort at JSC. It must be re-emphasized that these activities are highly dependent on the final NASA budget for FY 96, but planning should begin to provide the detailed schedules/milestones to effectively measure progress.

The proposed NASA Headquarters workforce downsizing implementation will have an impact on the NDE program. Current planning calls for the transfer of the NDE program manager responsibilities to a center (not yet defined) during 1996. I will continue in my role as NDE

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program manager until the where, when, and how the transfer of the NDE function can be worked out. I am going to hold this responsibility in addition to my new function as Mission Assurance Manager for MARS 98, SOFIA, and ISS/S-1'S payloads. As part of the restructuring my code designation has been changed to QT.

NNWG HIGHLIGHTS

Dr. Y. Ilar-Cohen, 818-354-2610 & Dr. G. Baaklini 216-433-6016

Several activities have taken place since the last issue of the NN WG Newsletter.

2nd NNWG ANNUAL MEETING WAS HELD AT MSFC, HUNTSVILLE, AL

The NASA NDE Working Group (NNWG) held its 2nd Workshop from May 9 to 10, 1995 at Marshall Space Flight Center (MSFC), Huntsville, Alabama. The meeting was hosted by Bob Neuschaefer and Dr. Sam Russell of MSFC. Individuals from all the NASA Centers (except for Stennis Space Center) attended the meeting and were given an opportunity to tour the MSFC facilities on May 8, 1995. The meeting was attended by Dr. Michael Greenfield, Deputy Associate Administrator, Code Q, and Joseph Siedlecki, the NDE Program Manager both from NASA Headquarters. The meeting included a review of the on-going RTOP programs, presentation of NASA Centers organizational and technical issues of concerns, review of the Strategic Plan and presentation of the top six proposed RTOP for FY'96.

Dr. Michael Greenfield reviewed the NASA Headquarters trend and his expectations of the NNWG. He emphasized the need to assure the relevance of NDE activity to existing and future flight programs, with a cheaper, faster and better NDE hardware and methodologies. He informed the attendees that HQ is expecting to have a 40% reduction in force and the transfer of various technical programs to the NASA Centers. He showed charts of the NASA funding profile and indicated that FY'95 is the turning point for decrease in funding. He also indicated that one of the Centers will be assigned to be the lead for managing the NDE activity in the future. Followed his talk, the currently funded RTOP programs were presented by the various NASA Centers' Principal Investigators. Each presentation was followed by questions and comments by the participants. At the close of this session, Dr. Greenfield summarized his positive impression of the presented material.

NNWG would like to thank Bob Neuschaefer for his timely issuance of the Meeting Proceedings. The proceedings was been distributed by MSFC directly to the attendees.

NASA NDE STRATEGIC PLAN WAS COMPLETED AND SIGNED

The NASA NDE Strategic Plan was completed and signed by all the NASA Centers and NASA HQ Code QW management. This development followed a Telecon that was held NASA wide on June 16 in which all the open issues were debated and a consensus was reached.

AN ORBITER STANDING COMMITTEE WAS FORMED

A committee that oversee the concerns, needs and future direction of the NDE technology for the Orbiter was formed and Rick Russell was elected its Chair. Rick who was the initiator of the Committee and he organized so far two telecons on the subject. These Telecons are held monthly and involves NASA and contractors participants.

ON- ORBIT NDE - During the NN WG Telecon, that was held in June, Charles Salkowski and Marie Havican of JSC presented the status of their On-Orbit Working Group activity and needs. The objective is to determine requirements and contingencies involving on-orbit NDE. The emphasis is on Space Station NDE issues associated with analysis of its design life and maintenance plans. The general consensus has been that NNWG will support the on-orbit activity and information will be discriminate to the Working Group members,

CODE Q STANDING COMMITTEE HIGHLIGHTS

R. Neuschaefer 205-544-7382

MINUTES OF NASA NDE WORKING GROUP (NNWG) CODE Q COMMITTEE LESSONS LEARNED TELECON - On June 29, 1995, a Code Q Committee Telecon was



Attendees of the NNWG meeting at the site of the evening event.

Back Row from the left: John Segreto, ARC, Ed Generazio, LaRC, Bill Winfree, LaRC, Rick Russell, KSC, Charles Salkowski, JSC, Robert Vince, JPL, Jim Chern, GSFC, Joe Siedlecki, HQ.
Front Row from Left: Marie Havican, JSC, Chien Nguyen, KSC, Brad Parker, GSFC, Sam Russell, MSFC, John Larson, KSC, Yoseph Bar-Cohen, JPL, George Baaklini, LaRC)

held. Chern of GSFC presented summary and issues related to the FY'96 RTOP review. The following is a summary of its decisions: (1) The Committee will work on NASA NDE needs, (2) All RTOP proposal submittals should be coordinated through Center representatives. A NASA personnel is ultimately responsible for the RTOP. (3) Supporting documents serve as bona fide proof of responding to customer needs. It needs to identify program endorsement in the proposal.

The Committee approved the revision of the RTOP review process suggested by Neuschaefer/MSFC. After collecting RTOP proposals (via fax, e-mail, etc.), the Committee will have a Telecon (or Vits) for short presentation and Q&A session prior to the first ranking of the RTOP proposals as the first screening process. The top five (or six) proposals will be invited to present the proposal at the NNWG Workshop or (via Vits or Telecon) before final ranking.

The Committee approved Bar-Cohen/JPL's suggestion that the term for the Code Q Committee runs from July 1 to June 30. Mr. Neuschaefer/JPL thus will assume the Chair position and Dr. Generazio/LaRC will assume the position as the Vice-Chair on July 1. The Committee voted to reject the change of "Code Q Standing Committee" to "Technical Review Committee". The name "Code Q Standing Committee" thus is unchanged. The Committee Telecon is open to all interested NNWG members. However, the request to participate in a Telecon needs to work through the respective Center representative.

Orbiter NDE Sub-Committee (ONSC)

R. Russell, 407-861-4168

The NNWG has formed an Orbiter Sub-Committee. This Sub-Committee will be chaired by Rick Russell of KSC. The main purpose behind the formation of this Sub-

Committee is to create a consolidated forum which will enhance the communications between all parties who are involved in NDE of the Space Shuttle Orbiter. Its goals include the identification of needs and of new technology to meet these needs, aid in the implementation of new technology, reducing redundancies and information sharing. Unlike the core NNWG, this Sub-Committee is open to both government and contractor personnel.

To date ONSC has had two telecons and has compiled a summary of current projects, ideas and concerns. Each participant was asked to give a brief overview of their inputs. Future telecons will provide a more in-depth discussions of selected current projects, detailing how the projects are meeting Orbiter NDE needs. The group will also provide a forum for the discussion of new needs and possible technologies to meet these needs. Also, new projects will be reviewed to prevent duplication of effort.

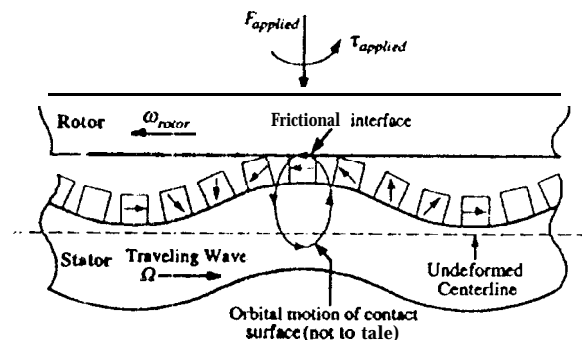
NNWG PERSONNEL NEWS AND ACHIEVEMENTS

Mr. NEUSCHAEFER OF MSFC BECOMES THE CHAIR OF THE NNWG CODE Q COMMITTEE - Pertaining to the Telecon of June 20, 1995, Mr. Bob Neuschaefer/MSFC assumes the Chair of the NNWG Code Q committee and Dr. EdGenerazio/LARC becomes the Vice-Chair of the Committee effective July 1, 1995. Dr. EdGenerazio will assume the Chair once a new Vice-Chair will be elected next year. NNWG Code Q Committee will coordinate the submittal, evaluation and recommendation of NDE RTOP proposals.

NASA CENTERS NEWS AND ANNOUNCEMENTS

GSFC (Dr. E. J. Chern, 301-286-5836)

NEW CENTER DIRECTOR APPOINTED AT GSFC - On July 27, 1995, NASA Administrator Mr. Daniel Goldin named Mr. Joseph H. Rothenberg as the Director of GSFC, effect immediately. Mr. Rothenberg has served as Deputy Director since April 24, 1995, and has been Acting Director after the departure of Dr. John Klineberg. Prior to returning to GSFC, Mr. Rothenberg was the Executive Vice President of Computer Technology Associates, Inc., Space Systems Division from February 1994 to April 1995. Mr. Rothenberg was the Project Manager for the Hubble Space Telescope Project until he resigned from GSFC in February 1994. Deputy Director will not be appointed until the end of September. Mr. Vern Weyers, Director of Flight Projects, will be acting as the Center's Deputy Director until then.



Principle of Flexural Traveling Wave Motor

JPL (Dr. Y. Bar-Cohen, 818-.254-2610)

TRAVELING FLEXURAL WAVES DRIVE PIEZOELECTRIC MOTORS

-An analytical model for piezoelectric motors is currently being developed with Prof. Nesbitt Hagood from MIT. The motors are employing ultrasonic flexural traveling waves and are driven by piezoelectric materials. The technology that has emerged recently in Japanese commercial products, such as cameras and watches is being adapted to space requirements for operation at a wide range of temperatures down to cryogenic levels and in vacuum. To establish a USA manufacturing

capability, a Technology Cooperative Agreement was signed recently with QMI, which is a local manufacturer with extensive experience with piezoelectric transducers and plate waves. In parallel to the development of a unique high torque motor at MIT, a prototype motor was recently designed by JPL and fabricated by QMI.

CONTACT COUPLED GUIDED WAVES FOR COMPOSITES ELASTIC

PROPERTIES NDE - Jointly with Prof. Ajit K. Mal from UCLA, a study is underway to develop a contact-coupled ultrasonic guided wave methods for determination of the elastic properties of composite materials. Analytically it was shown that shear deformation plate approximation leads to a very good agreement with the exact solution for wave frequencies below 0.5 MHz. Experiments were conducted using contact-coupled low frequencies and the fiber dominated constant C_{11} , which is associated with Young's modulus along the fibers, was determined and agreed with documented data. This effort is a precursor to the new joint JPL/LaRC RTOP program that is expected to start in October 1995.

LaRC (Dr. Edward R. Generazio, 804-864-4970)

PORTABLE SURFACE CONTAMINATION INSPECTION SYSTEM DEMONSTRATED -

LaRC is developing a portable surface contamination inspection system, for the MSFC, based on the principle of Optically Stimulated Electron Emission (OSEE). The hand held system has a 1" measurement area and allows the operator to perform spot checks on metal and insulating surfaces. The 1-lb system is also designed to be mounted to a robotic scanner for automated inspections. The initial application for the OSEE system is Solid Rocket Motor (SRM) bond line inspection. One of the design goals for the OSEE system is a contaminant resolution of less than 1 nanometer which

equates to a sensitivity of approximately. $0.1 \mu\text{g}/\text{cm}^2$. This is more than 10 times the sensitivity of any existing commercial system. The LaRC developed instrument is also lighter and has 10 times the measurement bandwidth for faster inspections. Several LaRC developed improvements account for the increased performance including the use of a dry argon atmosphere, use of monochromatic light, a parallel electric field geometry for the pick-up grid and improvements in the electronic circuitry. This 1-year program has reached its first major milestone with the laboratory demonstration of OSEE operation on D6AC Shuttle SRM steel. Operational tests of the initial prototype are being used to refine the electrical and mechanical design in preparation for the fabrication of the final instrument.

NONINVASIVE INTRACRANIAL PRESSURE MONITOR BEING TESTED AT NASA AMES -

A noninvasive monitor for assessing intracranial pressure (ICP) and pressure-volume index (a measure of physiological health) for victims of head trauma and pathological encephalitis has been developed by Drs. John Cantrell and Tom Yost at LaRC's NESB. Previous clinical assessments of ICP have relied on invasive techniques requiring the surgical implantation of sensors within the cranial vault. Clinical testing of the LaRC developed instrumentation and methodology has been initiated at NASA Ames Research Center under the direction of Dr. Alan Hagens.

ULTRASONIC PHASED ARRAY TESTBED SYSTEM (UPATS) DELIVERED -

The Ultrasonic Phased Array Testbed System, developed under contract by Southwest Research Institute (SwRI), was delivered and installed in the ultrasonic scanning lab of NESB. The UPATS provides full waveform, amplitude and delay control of transmit and receive functions of up to 100 ultrasonic transducers. This high degree of control enables such

functions as variable focus, variable aperture, beam steering and phase aberration corrections to be performed. In addition to the 10x10-element 2 MHz array which came with it, the system can be used to operate other arrays, including several units already in house, and others which will be designed and fabricated to meet specific research requirements. The UPATS will serve as the basis for: basic R&D of ultrasonic array probe design concepts, such as phase-insensitive detection and random phase detection; applied laboratory studies of ultrasonic properties of material systems, such as the propagation parameters of textile composites; and development of application-specific design parameters for complex-geometry inspections, such as the inspection of bond lines in the dome regions of solid rocket motors and the inspection of composite-armored vehicles.

OPTICAL FIBER FTIR FOR REMOTE QUANTITATIVE DETECTION OF ALUMINUM HYDROXIDE CORROSION PRODUCTS - Spectral data has been collected for aluminum hydroxide corrosion product using an optical fiber Fourier transform infrared evanescent wave absorption method. The data was obtained in the three micrometer spectral range. A two meter segment of plastic coated 200 micrometer core diameter chalcogenide optical fiber was integrated into the optical path of a four wavenumber resolution Michelson interferometer spectrometer to make the spectral measurements. Spectral data were collected with progressively longer segments of the fiber covered with aluminum. The decoated core was covered in increments of 10-cm, up to a total of 80-cm. Formation of aluminum hydroxide is a major product of corrosion in aluminum and aluminum alloys. The experimental data will demonstrate the linearity of spectral absorption as a function of fiber length covered by the aluminum hydroxide. This will establish the minimum amount of corrosion that can be detected, given the experimental sensitivity

(SNR). Also, this will be a reference to perform quantitative analysis of field spectra if the technique is put into practice

LeRC (Dr. G. Baaklini, 216-433-6016 and Dr. D. J. Roth, 216-433-6017)

NDI OF RESIDUAL STRESSES IN METAL MATRIX COMPOSITES HELPS IMPROVE FATIGUE LIVES - Ultrasonic velocity and neutron diffraction measurements are used to determine residual stresses in metal matrix composite (MMC) materials after fabrication to guide the thermal processing or the heat treatment of these composites before thermal-mechanical fatigue evaluation. The theoretical basis for two approaches using ultrasonic wave velocity measurements to determine residual stresses have been developed and modeled demonstrating adequate sensitivity. One of the approaches is based on phase velocity stress-temperature dependence. Thermal-mechanical processing conditions with potential for modifying the as-fabricated residual stresses in SCS-6/Ti-6-2-4-2 MMC were modeled and applied to test samples which were fatigued tested. Test of cooling under tension from high temperature, produced improvement fatigue lives 3X over as-fabricated baseline.

[ULTRASONIC VELOCITY IMAGING CHARACTERIZES MICROSTRUCTURAL EFFECTS IN COMPOSITES WITH VARYING THICKNESS - Beta-tested velocity imaging software that eliminates effects of thickness variations appears to be working correctly so that variations seen in ultrasonic images are now only due to microstructural effects. Polymer matrix composite samples appearing to have microstructural gradients based on conventional ultrasonic C-scan, were evaluated using the velocity imaging software which indicated that the gradients are due to thickness effects and no microstructural gradients exist. This type of imaging allows better quality control for advanced composites.

MSFC (R. Neuschaefer 205-544-7382 and Dr. S. Russell, 205-544-4411)

SHEAROGRAPHY - Under this RTOP effort, significant progress was made this past quarter including inspection of the Solar X-Ray Imager Optical Bench, DCX-A Composite Feed Line, and a US Army drone wing as part of a technology transfer agreement. Development activities resulted the publication of a NASA Technical Memorandum on "Probability of Detection of Defects in coatings with Electronic Shearography", completion of a calibration Tech Brief, and completion of a study on "Statistical Optimization of Shearography Inspections" by Dr. Temple under the Summer Faculty Program.

THERMOGRAPHY- As a result of the progress made during this past quarter, the goal of bringing advanced thermography as an on-line NDE tool at MSFC was brought significantly closer. A Bales Thermography system was received along with ancillary equipment. Work was initiated to develop training and personnel certification requirements for the inspection of laminated composites.

Representative samples of the External Tank composite nose cone and Pegasus fairing were tested. LaRC, as a partner in this RTOP, is working to develop thermal diffusivity models.

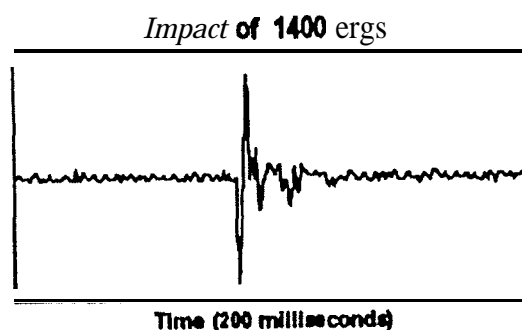
NDE OF SILICON NITRIDE BEARINGS FOR SSME LIQUID HYDROGEN

ALTERNATE TURBOPUMP - Liquid hydrogen testing of space shuttle alternate fuel turbopump silicon nitride bearings will start in September 1995. We expended much effort in bringing an abandoned hydrogen facility to useable status. Silicon nitride test elements are fully inspected prior to testing in order to establish an NDE baseline. These elements are reinspected after each of three test series to evaluate any flaws introduced during testing.

INDUSTRY AND ACADEMIA NEWS

ABACUS OPTICAL MECHANICS, Oxnard, CA, Anthony G. Bledin, M. D., 818-597-0453

NEW FIBER OPTIC SENSOR - An intensity-base interference-type fiber optic sensor was recently developed for structural health monitoring applications. The sensor system consists of a small optoelectronic box containing laser, detectors and their associated electronic components that are connected to a fiber trunk. The fiber trunk consists of 12 individual fibers maximum which are used in pairs offering maximum of 6 sensing points per trunk. The fiber can be attached or imbedded in the test structure and can be used to sense vibrations up to several KHz. Some of the sensor applications include monitoring impact and acoustic emission as well as vibration analysis.



Abacus fiber monitoring impact

ACOUSTIC TECHNOLOGY GROUP, Sacramento, CA, Allen Green, 916-483-1311
SURVEY OF ACOUSTIC EMISSION APPLICATION TO PRESSURE VESSELS

AA'D TUBING - Recently, Acoustic Technology Group completed a survey of the international applications of acoustic emission to pressure vessels and tubing.

AMERICAN SOCIETY FOR NON-DESTRUCTIVE TESTING (ASNT), Columbus, OH, Terry Fogle 800-222-2768

ASNT IS FORMING AN NDE ELECTRONIC NETWORK - ASNT is currently beta testing its recently formed ASNT Net as an NDT bulletin board system. This is the first step that ASNT has taken to join the information superhighway technology. This ASNT network is intended to create an electronic forum of communication among the users, provides news, product information and announcements.

AIR TRANSPORT ASSOCIATION, Washington, D.C., Steve Erickson, 202-626-4000

A TA MEETING IN SEPTEMBER - The Air transport Association will be hosting its annual NDT Forum on Sept. 26-28, 1995, in Hartford, Connecticut. This theme of this year's Forum is "NDT Technology Today: Enhanced Safety, Reliability, and Savings". The conference's special emphasis will be on regional/commuter operations, will include a facility tour of the Pratt&Whitney Technology Center. At this meeting, NASA LaRC will present a paper on the application of self-nulling eddy-current probe to airframe structures. This probe was developed under the NASA' Airframe Structural Integrity Program.

CERRITOS COLLEGE, CA, Terry Price (310) 860-2451, Ext. 2927, fax (310) 467-5012 Composites-info@ ccrritos.cdu.

NDE OF COMPOSITE SEMINAR

SPONSORED BY ARPA - Under a TRP (Technology Reinvestment Program) contract with ARPA, Cerritos College held from August 10 to 11 a seminar on NDE of composites. This two-day Seminar covered various aspects and problems with structures health management and impact damage assessment of composite materials. The presentations covered methods and capabilities of embedded/attached/remote sensors, Airscan ultrasonics, micro-radar imaging, real time radiography, and the latest techniques in thermographic imaging. Further, demonstrations were made of acoustic emission monitoring of a panel during failure, and the

capabilities of non-contact testing to assess impact damage.

DENVER RESEARCH INSTITUTE (DRI), Denver, CO, Dr. Leonard Bond, Chief Scientist, 303-871-2427, fax 303-871-4984, lbond@du.edu

TRANSFER OF NDE INSTRUMENTATION TECHNOLOGY - DRI is the Applied Science Dept. of the University of Denver and is an independent non-profit laboratory established in 1946. Its Center for Applied Metrology and Instrumentation (CAMI), developed from an Instrumentation Group, supports a wide range of studies of explosive events, shock and impacts. CAMI, which was established in 1994, is involved extensively in NDE, quality control and process measurement R&D tasks. CAMI is now seeking the transfer of its instrumentation capabilities, which were developed under DoD support, to new areas. CAMI expertise includes high speed and ultra-high speed photography (up to 1.5 million frames per second), flash X-ray, sensor systems and digital data acquisition, damage mechanisms analysis as well as combustion measurement using IR. Current activities include analysis of high speed metal forming processes, die material characterization, ultrasonic tissue characterization and an analysis of ultrasonic surgery. A 4th generation digital data acquisition system has recently been designed for use at remote sites, which provides 20 channel high speed data acquisition "in a suit case" which can be used with combinations of optical fiber, pressure, strain, acceleration and other sensors. More information is available via <http://www.du.edu/tilda.dri> which is the Center's new world wide web homepage.

IOWA STATE UNIVERSITY CENTER FOR NDE (CNDE), Dale Chimenti, 515-294-6240, chimenti@iastate.edu

WIDE RANGE OF NDE ACTIVITY AT

CNDE - The Center for NDE at Iowa State University has been active in areas related to

NDE R&D for more than 10 years. Areas of application of the NDE technology includes, aerospace, aircraft, nuclear, etc. Specifically, CNDE is currently developing eddy currents and pulsed eddy current methods for corrosion detection and layered structure characterization, X-ray methods and energy-sensitive backscatter, computed tomography, and a wide range of ultrasonic investigations from acoustoelasticity and air-coupled methods to defect detection in the presence of texture noise. These NDE efforts are directed to a wide variety of materials including polymer, metal -matrix and ceramic-matrix composites to sheet aluminum, cast aluminum, reactor steels, and superalloys. CNDE, which is a membership-base center, consists of about 25 principal investigators, 30 postdocs and technicians, and 60 students and holds two sponsor meetings each year.

NDT NEWSGROUP, **Marty Jones, Ph.D.**
(**MatSciNDT@AOL.COM**)

NDT NEWSGROUP WAS FORMED - A new NDT Newsgroup **sci.techniques.t testing. nondestructive** has been formed recently and it is an open electronic form of communication. If you do not have access to a newsgroup news readers but would like to participate, there are several other ways to do it. Most importantly there is an E-mail discussion list access to the Usenet newsgroup gateway setup exclusively to support and reflect the NDT Newsgroup. It is possible to reach newsgroups through **bbs.oit.unc.edu** via TELNET.

The following are by professional courtesy of Dr. Keith Pickens of SwRI:

This discussion group is dedicated to all aspects of NDE and related science and technology. Its Mailing List was founded at the NATO Advanced Research Workshop "Advances in Signal Processing for Non Destructive Evaluation of Materials". This workshop was organized by a group headed by Professor Xavier Maldague and was hosted by University Laval in August 1993. Dr. Keith Pickens of

SWR1 has agreed to set up and maintain the list, and provide the necessary computing resources.

The newsgroup **sci.techniques.testing. nondestructive** was proposed by Dr. Martin Jones in March 1995. Through the campaign efforts of many, especially Mr. Russell Austin of NTIAC, the vote for the newsgroup passed in June 1995 and the group was created in July 1995. The newsgroup and mailing list are connected by a gateway at SwRI.

To have an electronic mail address added to or dropped from the list send mail to: **nde-request@swrinde.nde.swri.edu** with a command to "subscribe" or to "unsubscribe" in the body of the email message. To send a message to all members of the mailing list use this address: **nde@swrinde.nde.swri.edu** The **sci.techniques. testing. nondestructive** the Newsgroup web page is:
http://www.nde.swri.edu:8080/

The goal of the web page is to provide a central location for NDE/NDT related resources. Please send email to **ksp@swrinde.nde.swri.edu** if you know of a resource which isn't listed.

Messages sent to the mailing list and to the newsgroup are available for ftp. To retrieve the archive, open an ftp connection to the host: **swrinde.nde.swri.edu** Give the user id: anonymous Give your mail address as the password: **my-login@ndt-research-host** The NDI archive can be found in the directory: **pub/nde**. If you have a data set, documentation, or software which you would like to have placed on the anonymous ftp server please send mail to **ksp@swrinde.nde.swri.edu**

QMI, Costa Mesa, CA, Willem Grandia, 714-631-7672

**PROTOTYPE PIEZOELECTRIC MOTOR
MADE UNDER A TCA WITH JPL** - A technology Cooperative Agreement (TCA) has

been signed recently between JPL and QMI to jointly develop piezoelectric motors. These motors are employing ultrasonic flexural traveling waves that are induced by piezoelectric materials. In cooperation with Dr. Bar-Cohen and Dr. Lih of JPL, QMI has recently completed the development of its first ultrasonic motor. This motor technology is attractive for robotic applications for its miniaturizability and unique characteristics which make the motors effective for the new generation of spacecraft (compact, low mass and consume low power).

COMING EVENTS

- Sept. 26 to 28, 1995- Air Transport Association (ATA) 1995 NDT Forum, "NDT Technology Today: Enhancing Safety, Reliability, Savings," - Hartford, Connecticut, NAARP 609-645-2881
- ASNT Fall Conference - NDE: The Lone Star of Quality, Dallas, TX, ASNT Headquarters, 614-274-6004.
- Dec. 4-8, 1995- JANNAF Propellant Meeting, Joint Subcommittees Meeting including NDE - Tampa, FL. CPIA 410-992-7304.
- December 1996- 14th World Conference on NDT - New Delhi, India, Dr. Baldev Raj, 04117-40301
- January, 1995- 3rd NNWG Workshop - KSC, Florida, Yoseph Bar-Cohen.

NASA NDE Working Group (NNWG) Newsletter

This NNWG Newsletter is published quarterly by the NNWG and NASA HQ, Code QW.

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